

## **WHAT IS CLAIMED IS:**

1. A method of making a lithiated manganese dioxide for a primary lithium battery comprising:
    - contacting a manganese dioxide with a lithium ion source at a lithiation temperature sufficient to substantially replace protons in the manganese dioxide with lithium ions; and
    - heating the manganese dioxide at a water removal temperature sufficient to substantially remove residual and surface water to produce a lithiated manganese dioxide having an X-ray diffraction pattern substantially similar to the X-ray diffraction pattern of the manganese dioxide prior to lithiation.
  2. The method of claim 1, wherein the manganese dioxide is persulfate derived chemical manganese dioxide.
  3. The method of claim 1, wherein the manganese dioxide is gamma-manganese dioxide.
  4. The method of claim 1, wherein the lithium ion source is an aqueous solution including a lithium salt.
  5. The method of claim 4, wherein the lithium salt is a lithium hydroxide.
  6. The method of claim 1, wherein the lithiation temperature is between 40 C and 100 C.
  7. The method of claim 1, wherein the water removal temperature is between 180 C and 500 C.
  8. The method of claim 1, wherein the water removal temperature is between 200 C and 460 C.
  9. A method of making a cathode for a battery comprising:
    - contacting a manganese dioxide with a lithium ion source;
    - heating the manganese dioxide to produce a lithiated manganese dioxide

4 having an X-ray diffraction pattern substantially similar to the X-ray diffraction pattern of the  
5 manganese dioxide prior to lithiation; and

6 coating a current collector with a composition including a carbon source, and  
7 the cathode active material, wherein the cathode active material includes a manganese  
8 dioxide.

1 10. The method of claim 9, wherein the manganese dioxide is persulfate derived  
2 chemical manganese dioxide.

1 11. The method of claim 9, wherein the manganese dioxide is gamma-manganese  
2 dioxide.

1 12. The method of claim 9, wherein the lithium ion source is an aqueous solution  
2 including a lithium salt.

1 13. The method of claim 12, wherein the lithium salt is a lithium hydroxide.

1 14. The method of claim 9, wherein the lithiation temperature is between 40 C  
2 and 100 C.

1 15. The method of claim 9, wherein the water removal temperature is between  
2 180 C and 500 C.

1 16. The method of claim 9, wherein the water removal temperature is between  
2 200 C and 460 C.

1 17. A primary lithium battery comprising:  
2 an anode including a lithium-containing anode active material;  
3 a cathode including a lithiated manganese dioxide having an X-ray diffraction  
4 pattern substantially similar to the X-ray diffraction pattern of the manganese dioxide prior to  
5 lithiation; and  
6 a separator between the anode and the cathode.

1 18. The battery of claim 17, wherein the lithium-containing anode active material  
2 is lithium or a lithium alloy.

1        19. The battery of claim 17, further comprising a nonaqueous electrolyte in  
2 contact with the anode, the cathode and the separator.

1        20. The battery of claim 19, wherein the nonaqueous electrolyte includes an  
2 organic solvent.

1        21. The battery of claim 17, wherein the battery has high current capability and  
2 discharge capacity greater than a lithium-manganese dioxide battery including heat treated  
3 manganese dioxide.